What causes thunderstorms to form and what is the life cycle of a storm?

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Unit Essential Question: What ingredients in the atmosphere come together to form a thunderstorm?

Teacher Background:

Lesson Overview:
Students will learn about the three primary ingredients needed for a thunderstorm to develop. The ingredients are: moisture, lift and instability. Students will develop a basic understanding for the life cycle of a thunderstorm, known as the cumulus stage, mature stage and dissipating stage. The primary emphasis of this lesson will be how thunderstorms develop within the atmosphere.

Potential Misconceptions:
Thunderstorms only develop in the spring and summer months. False. While the majority of the thunderstorms develop during the spring and summer across the United States, thunderstorms can develop any time of the year. Thunderstorms just need all the right ingredients to come together and strong and even severe thunderstorms that produce tornadoes can develop in the middle of winter.

Lesson Goals:

Objective:	Students will be able to demonstrate knowledge of terms through question and answer.
Learning Target:	Use provided weather graphics to explain to the students how thunderstorms form in the atmosphere and their life cycle.

Standard Information

Performance Expectation (PE)	**KESS3-2: Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.**

Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. • Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world.	**ESS2.D: Weather and Climate** Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. **ESS3.B: Natural Hazards** Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.	**Cause and Effect** Events have causes that generate observable patterns.

Lesson Preparation:

Materials:	Group Size:	Management:
Short story Graphics (How do thunderstorms form with Owlie) Thunderstorm Types (4 graphics) Thunderstorm development Graphics (Life cycle of thunderstorm)	***Whole class***	At the end of this lesson table, you will find graphics that you will combine to provide a short story to your students to discuss how thunderstorms form. Graphics will be provided of Owlie that shows four different types of thunderstorms. Also, a graphic describing the life cycle of a thunderstorm is attached.

Lesson Plan:

Suggested Timing	Agenda:
20 min 10 min 10 min	How do thunderstorms form? Owlie with thunderstorms. What is the life cycle of a thunderstorm?

Teaching Procedures:	Teaching Notes

Engage

1. Read the story to your students. Ask the students if they were familiar with the environment that thunderstorms develop in. Do they know what it is like when it is very humid outside versus dry? Ask the students if they see a change in the clouds when thunderstorms are expected during the afternoon from that morning? During the spring and summer months the sky is often clear in the morning but can quickly develop a cumulus field which covers most of the sky. The clouds often look like cotton candy; they are often described as fluffy shaped. Ask the students if they can describe the shape (see life cycle of a thunderstorm graphic to see a cumulus cloud). Ask the students what air mass thunderstorms form in. Do they form in warm, hot or cold? Talk about rising and sinking motions. Hot air rises and cold air sinks, thus thunderstorms must develop in warmer or hot environments.
2. Thunderstorms are complex and need multiple factors to work together in order to survive. In its most basic form it needs three factors to survive: moisture, lift and instability. Ask your students if they find anything surprising about how thunderstorms form from what they learned in the story. Ask the students if they are surprised that thunderstorms form along warm and cold fronts. Ask the students if they know that most severe storms (storms that produce large hail, strong winds or tornadoes) form along a cold front. Cold fronts are a powerful driver for severe weather. It can violently force warm air upwards to help generate thunderstorms and help make them become severe.
3. Thunderstorms come in all shapes and sizes and can last anywhere from thirty minutes to several hours. Show the students the Owlie graphics displaying four different types of thunderstorms. Ask the students if they can describe what is different in each graphic.
4. Thunderstorms always go through a cycle from cumulus stage (rising air and eventually condensing into a cloud) to a dissipation state (to where the thunderstorm is rain dominant and it will eventually rain itself out and become just a cloud again). Show your students the graphic of the life cycle of a thunderstorm. Go over each step and explain how no matter what a thunderstorm will always follow this cycle, like other cycles in nature.

Science Notebook:

Make sure students DATE each page of their notebook.

Ask the students to draw a picture and/or write about one new fact they learned about thunderstorms today.

Assessment:

Formative Assessment: In their Science Notebooks draw or write what excites them about thunderstorms.

Literacy Connections:

Vocabulary		Included or Suggested Texts (Title; *Author*, Year, Type (book/article), Grade, LEXILE)
New or Recently Introduced	Familiar Terms	
Lift Instability	Tornado Lightning	

Moisture Warm front Cold front Saturated Cumulus	Strong Wind Large Hail	

Differentiation: *Below are some suggestions for modifying lessons for individuals or groups of students.*	
Students that may need more challenge:	Students that may need more support:

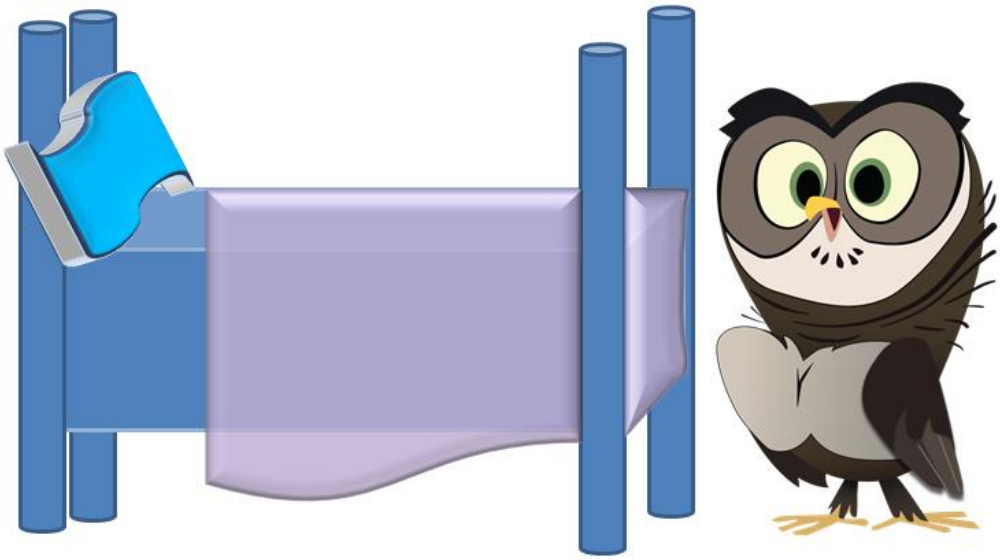
Think Outside the BOX!
ELA Math Others:
Reproducible Student Materials:
See next pages

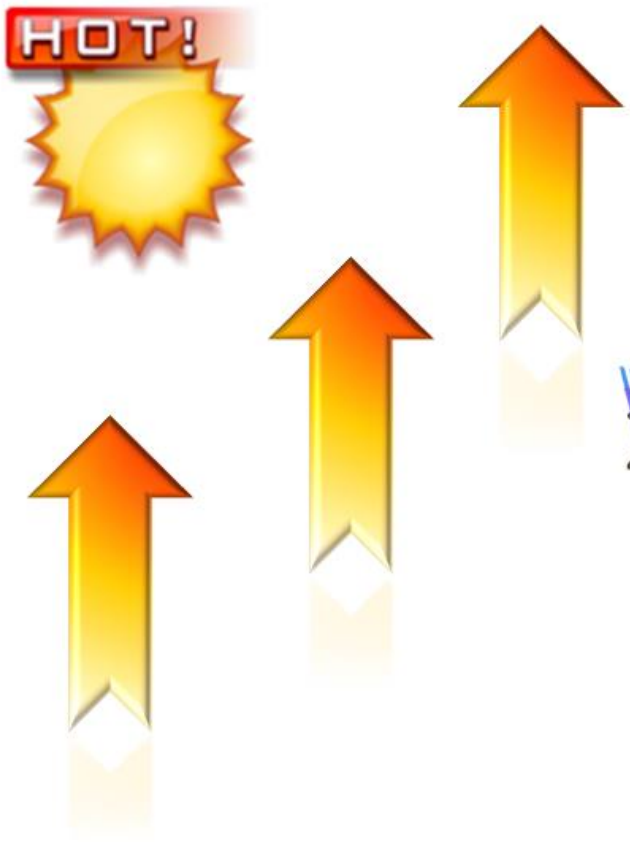
Name: _____

What causes Thunderstorms to form?

Let's explore a day with Owlie to discover how thunderstorms form!

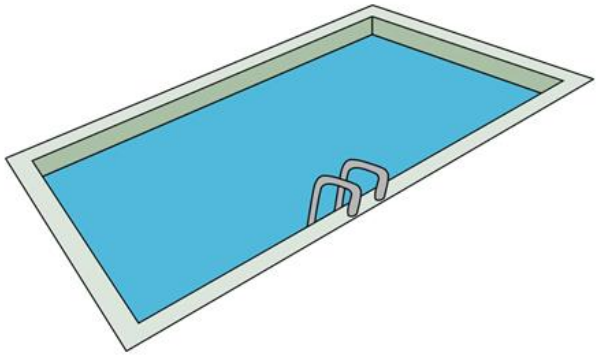
Like Owlie, the Sun rises every morning. The sun heats the ground. The ground feels warm and so does Owlie!





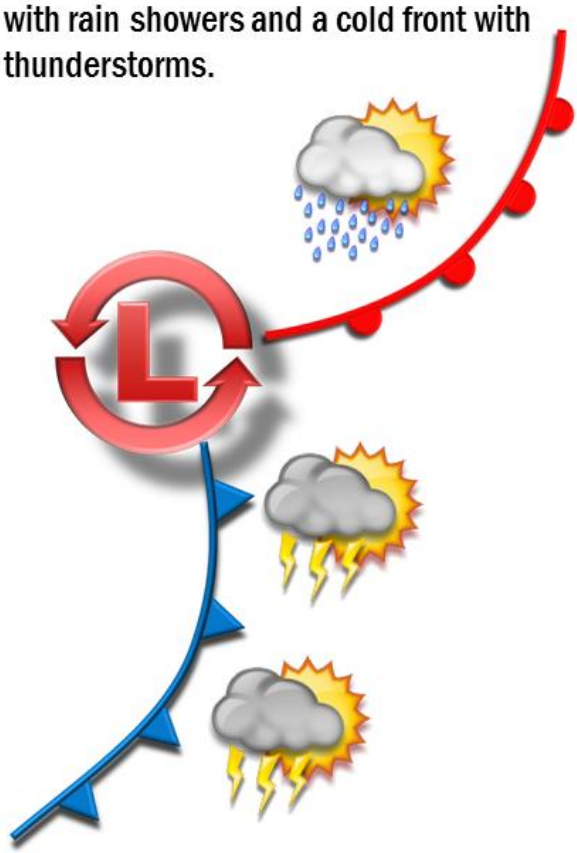
During the Spring and Summer the Sun warms the ground for several hours. Owlie feels hot. During this time warm air rises around him. So he heads to the pool!

At the pool Owlie notices how hot and humid it feels. He feels so sticky. Owlie wonders if there will be thunderstorms in the afternoon.



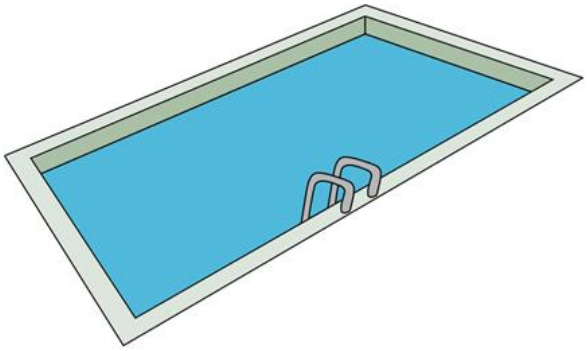
Owlie decides to pull out his NOAA weather radio to listen to the National Weather Service's forecast. His radio will tell him what is going on.

A low pressure system is moving towards the area. This system will bring a warm front with rain showers and a cold front with thunderstorms.



Thunderstorms are expected to form after 5 PM. Some of these storms may produce gusty winds.

Thunderstorms are in the forecast. I wonder how they form. I am going to go ask someone.



Owlie asks a meteorologist

Well Owlie, first you need a cloud. Warm air rises and cold air sinks. After the air rises and the air becomes saturated a cloud forms.

The cloud will become so moist that it cannot hold any more moisture. It will then start to produce rain.

Thunderstorms are unique. They are like baking a cake. You need all the ingredients in a cake measured just right otherwise it will taste awful. Thunderstorms are just like that. Three things must come together perfectly for a thunderstorm to form. Moisture, lift and instability.

Moisture gives you a cloud. Instability is just a fancy term for when it is hot and muggy outside. You know, does it feel sticky outside and have you seen the sun today?

Humid

And last but not least there is something called lift. Have you heard of a warm and a cold front? They lift air upward as they move forward. They come with surface low pressure systems. Lift, moisture and instability all three create a thunderstorm!

Wow! Thunderstorms are so cool! I better get home before they form. Thunder roars, go indoors.

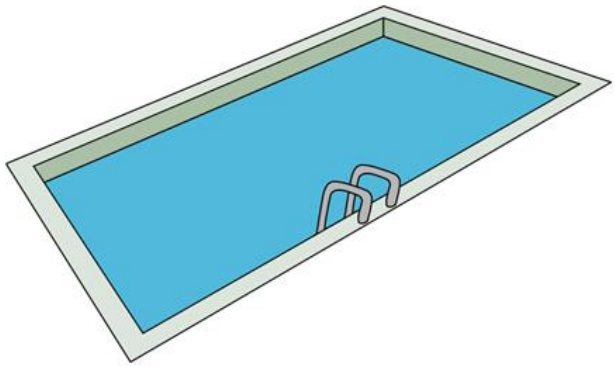


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Photo by: Rachel Humphrey

Life cycle of a Thunderstorm

Cumulus Stage

Rising air condenses into a cloud. "a baby storm"

Mature Stage

Rain reaches the ground. Lightning, thunder, hail, strong wind and tornadoes can happen at this time. "adult storm"

Dissipating Stage

Rain only. Storm slowly ends. At this time the storm can cause no harm. "the end"

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If you have any suggestions to improve the lesson, please contact us at: Katherine.Hawley@noaa.gov